

A Review of the Agile Species Group of *Pison* (Hymenoptera: Sphecidae: Trypoxylini)

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Abstract.—The agile species group of *Pison* is redescribed, the 12 included species are reviewed, and a key is provided for identification. The agile group is restricted to the Oriental and eastern Palearctic Regions, although one species, *koreense*, is adventive in North America. Five species are new: *agiloides* from Sri Lanka; *chrysoptilum* from Borneo; *ningyuenfuense* from southwestern China; *vechti* from Malaya and Indonesia; and *pulawskii* from India. Other species of the group are: *agile* (Smith) from southern India and Sri Lanka; *erythropus* Kohl from western India; *koreense* (Radoszkowski) from eastern Asia and North America; *rothneyi* Cameron from southeast Asia; *browni* (Ashmead) from the Philippines; *differens* Turner from Assam, India; and *hissaricum* Gussakovskij from Uzbekistan and Tajikistan. Lectotypes are designated for *agile*, *differens* and *rufipes* (Smith) and a neotype is designated for *koreense*. *Pison koreense* is removed from synonymy with *agile*.

INTRODUCTION

The genus *Pison*, which contains nearly 200 described species (Bohart and Menke 1976; Menke 1988), is well represented in all faunal regions except North America where only an adventive species, *koreense*, is known.

In this paper I review the agile species group which contains 12 species, five of which are new. Members of this assemblage have been placed in the subgenera *Pisonoides* and *Krombeiniellum*, but Menke (1988) used species groups rather than subgenera for infrageneric groups. The agile group is restricted to the eastern Palearctic and the Oriental Regions, except for the east Asian species *koreense* which was introduced into North America presumably after World War II (Krombein 1958a).

Morphological terminology used here follows Bohart and Menke (1976) and Menke (1988). The following abbreviations are used in the text: OOD = ocello-ocular distance; OD = ocellus diameter; POD = distance between posterior ocelli.

The following museum and institutions lent specimens for this study (abbreviations are used in the text):

- AUZM Universiteit van Amsterdam, Zoologisch Museum, Amsterdam, The Netherlands (W. Hogenes).
BMNH The Natural History Museum, London, England (C. R. Vardy, L. Ficken).

- CAS California Academy of Sciences, San Francisco, California (W. J. Pulawski).
NMNH Nationaal Natuurhistorisch Museum, Leiden, The Netherlands (C. van Achterberg).
OUM Hope Entomological Collections, University Museum, Oxford, England (C. O'Toole).
USNM U.S. National Museum, Washington, DC, USA (K. V. Krombein, A. S. Menke).
ZIN Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia (V. I. Tobias).
ZMK Zoological Museum, Copenhagen, Denmark (O. Lomholdt).

The specimens from the collection of the Zoological Museum of the Moscow State University (ZMUM) were also used in the review.

THE AGILE GROUP

This group is characterized as follows: compound eyes densely setose, antenna clavate, occipital carina complete or nearly so, anterior pronotal pit small, subomulus present, episternal sulcus straight, forewing with only two submarginal cells (true second submarginal cell lost through diminution), hindcoxa without dorsolateral carina, metapleural flange usually lamelliform, propodeum without lateral carina or crenulate ridge, male sternum VIII narrow, gonostyle simple, volsella small, penis valve compressed

laterally and without teeth or notched ventrally.

Menke (1988) regarded the setose eyes, the clavate antenna, the two submarginal cells, the presence of a subomaulus, the straight episternal sulcus, the lamelliform metapleural flange and claw shape as apomorphies of the *agile* group. Its species apparently represent a monophyletic assemblage. Morphologically they are very similar and differ mainly in leg color, tergal bands, punctuation, vestiture and proportions of tergum I. Male genitalia are also similar. One of the new species, *pulawskii*, stands apart from the others in the group because its metapleural flange is narrow. I regard it as a plesiomorphic state. Two other species have unique autapomorphies: in *browni* the propodeal dorsum is delimited laterally by a shallow, broad sulcus and tergum I has a distinct preapical depression; in *agiloides* submarginal cell II is open distally.

Description.—Inner orbits of eyes moderately emarginate, parallel (eyes equidistant at vertex and clypeus) or slightly converging below (rarely above); eyes covered densely with short, erect setae (Fig. 3); clypeus convex, in female rounded (Figs. 4a, 5a), in male angulate or prominent apically (Figs. 4b, 5b); frons convex; antennae clavate, comparatively short, with distal flagellomeres wider than long; labrum subquadrate, truncate or slightly emarginate apically; occipital carina a complete (or almost complete) circle, narrowly separated from hypostomal carina; male mandible simple, that of female with inner tooth slightly distad of midpoint; pronotum with small round pit anteriorly, without lamellae; scutum and mesopleuron moderately, uniformly punctate; episternal sulcus almost straight, not curved forward ventrad; subomaulus recurved ventrad; omaulus and acetabular carina absent; mesopleural sulcus paralleled anteriorly by a row of foveolae; metapleuron smooth; metapleural flange usually broadly lamelliform posteriorly (Figs. 6-8); tegula entirely punctate; forewing media diverging after cu-a; forewing with two submarginal cells (Figs. 10-13), 2nd

(really 3rd) usually not petiolate; recurrent veins received by 1st and 2nd submarginal cells or 2nd recurrent vein interstitial between 1st and 2nd submarginal cells; hind coxa dorsum with low inner carina, without outer carina; legs finely sculptured, without stout spines on tibiae and tarsomeres; all tarsomeres IV with small plantulae; tarsal claw thick to just before apex; propodeum rounded, without lateral carinae or lines of foveae and crenulate ridges, punctate with smooth interspaces; propodeal dorsum not delimited (*browni* with shallow lateral sulcus), with medium furrow containing short to complete ridge; abdomen compact; tergum I simple or with preapical transverse depression (Figs. 15-19); apical bands of terga often translucent and with silvery or golden pubescence; male sternum VIII long, narrow, rounded or weakly notched apically; genitalia compact, compressed laterally; volsellae small, rounded and weakly setose; gonostyle triangular, simple, with long, coarse lateral setae curved beneath; penis valve compressed laterally, considerably widened apically, without teeth or notches ventrally.

Included Species.—*agile* (Smith), *agiloides* sp. n., *browni* (Ashmead), *chrysoptilum* sp. n., *differens* Turner, *erythropus* Kohl, *hissaricum* Gussakovskij, *koreense* (Radoszkowski), *ningyuenfuense* sp. n., *pulawskii* sp. n., *rothneyi* (Cameron), *vechti* sp. n.

Biology.—Information is available for two species of the group, *koreense* and *erythropus*. The former was studied by Iwata (1964) in Japan and by Sheldon (1968) in North America. The Indian species, *erythropus*, was studied by Horne (1870). These wasps construct small, clay cells, placing them separately or in groups on variable surfaces, but not within linear cavities (borings in wood or empty stems of plants). The groups may include up to 21 cells which do not merge in a common mass but keep their independence. Prey consists of 6-31 paralyzed, small, usually immature spiders.

KEY TO SPECIES OF THE *AGILE* GROUP

- | | | |
|------|--|-------------------------|
| 1 | All femora completely reddish | 2 |
| — | Mid- and hindfemora brown, forefemora mainly brown | 6 |
| 2(1) | Metapleural flange narrow (Fig. 9); India | <i>pulawskii</i> sp. n. |
| — | Metapleural flange broadly lamelliform posteriorly (Figs. 6-8) | 3 |

- 3(2) Pronotum, scutum, scutellum, metanotum and propodeal dorsum and hindface with suberect golden setae; Borneo *chrysoptilum* sp. n.
 — Thorax and propodeum with only silvery pubescence 4
- 4(3) All legs including tarsi and base of trochanters yellowish-red; western India *erythropus* Kohl
 — Trochanters, hintibiae apically and tarsi dark brown 5
- 5(4) Abdominal tergum I densely punctate (punctures separated by a diameter or less), dull due to dense microsculpture; translucent apical bands of terga I-III whitish, at middle hardly broader than hindtarsal diameter; Uzbekistan, Tajikistan *hissaricum* Gussakovskij
 — Abdominal tergum I finely, sparsely punctate (punctures more than a diameter apart), surface smooth, weakly shiny in spite of microstriae; translucent apical bands of terga golden, broad, those of II-III at middle almost equal to diameter of hindtibia; Malaysia, Indonesia *vechti* sp. n.
- 6(1) Abdominal tergum I polished, sculpture nearly same as following terga 7
 — Abdominal tergum I dull or weakly shiny in contrast to following terga 8
- 7(6) Tibiae reddish; scutal punctures fine, dense, less than a diameter apart; translucent apical bands of abdominal terga golden, apical bands of terga I-III at middle at least twice as broad as diameter of hindtarsomere I; submarginal cell II open distally (Fig. 14); Sri Lanka *agiloides* sp. n.
 — Mid- and hindtibiae brown, foretibia partly reddish; scutal punctures coarse, more than a diameter apart; translucent apical bands of abdominal terga mainly whitish, those on I-III equal to or hardly broader than diameter of hindtarsomere I (Fig. 15); submarginal cell II closed; southern India and Sri Lanka *agile* (Smith)
- 8(6) Lamelliform part of metapleural flange mainly dark; translucent apical bands of abdominal terga not broader than diameter of hindtarsomere I 9
 — Lamelliform part of metapleural flange reddish at least posteriorly; translucent apical bands of abdominal terga (at least of terga II-III) obviously broader than diameter of hindtarsomere I 10
- 9(8) Abdominal tergum I dull, very densely, finely sculptured, transversely depressed preapically (Fig. 17); apical bands of abdominal terga II-III dark brown, that of tergum I narrower than hindtarsal diameter; propodeal dorsum delimited by shallow depression at least laterally; Philippines *browni* (Ashmead)
 — Abdominal tergum I shiny dorsally, coarsely, sparsely punctate, faintly transversely depressed preapically; apical bands of abdominal terga II-III yellowish, band on tergum I almost as broad as hindtarsal diameter and half as wide as band on tergum II; propodeal dorsum not delimited by depressions; southeastern China *ningyuenfuense* sp. n.
- 10(8) Translucent apical bands of abdominal terga I-II bright golden, of equal width; propodeum as long as wide (seen from above), with hind surface mostly punctate apically; ocelli (especially in male) small (OOD>OD); India: Assam *differens* Turner
 — Translucent apical bands of abdominal tergum I very narrow or absent; propodeum wider than long (seen from above), hind surface transversely carinate apically; ocelli larger (OOD<OD=POD) 11
- 11(10) Abdomen comparatively short, terga II-III twice as wide as long (dorsal view); translucent apical bands of female tergum I often absent, narrow on terga II-III (hardly broader than diameter of hindtarsomere I), bright golden; tergum I dull due to dense microsculpture; metapleural flange with narrower, densely pubescent lamella (Fig. 11); Russian Far East, Korea, eastern China, Japan, United States *koreense* (Radoszkowski)
 — Abdomen comparatively longer, terga II-III 1.5 times as wide as long; translucent apical band of tergum I present, those on terga II-III whitish-yellow; tergum I weakly shiny, with sparse microsculpture; metapleural flange with broader, spoon-shaped, sparsely pubescent lamella (Fig. 8); southeast Asia, Malaysia, Indonesia *rothneyi* Cameron

Pison agile (Smith)
 Figs. 3, 4, 6, 10, 15

Parapison agilis Smith 1869:300. Lectotype: female, "Ceylon" (now Sri Lanka) (BMNH), present designation.

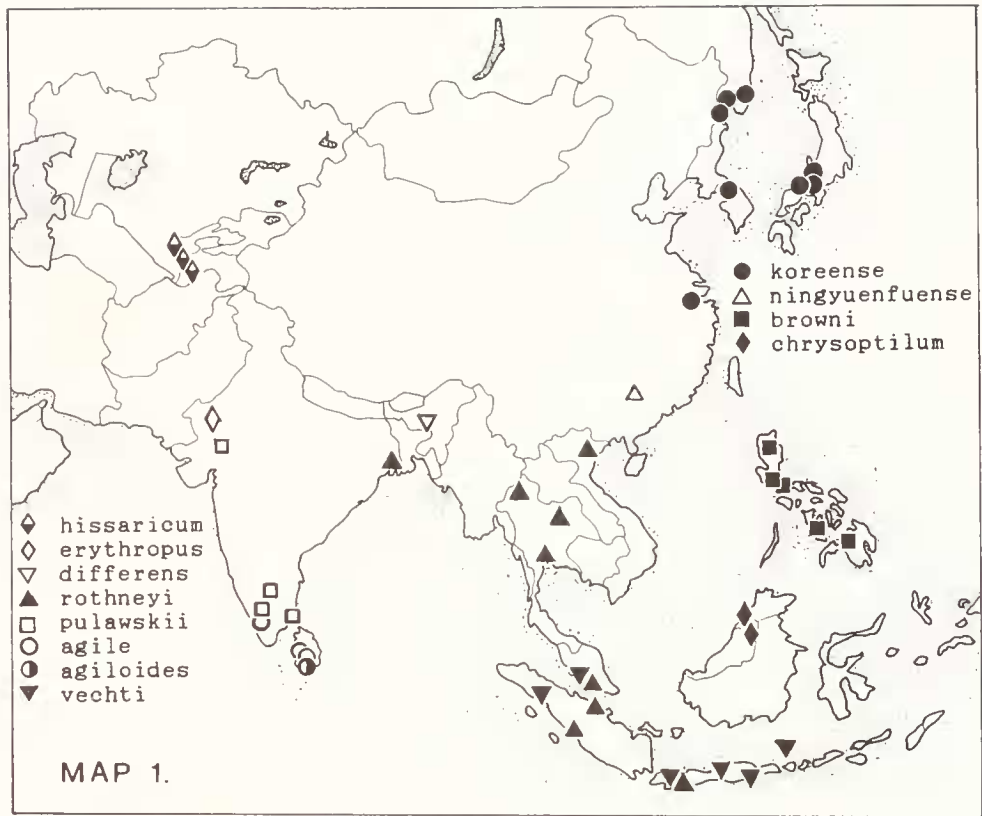
P. (Parapison) agile: Kohl 1885:186 (listed).

P. (Pisonoides) agilis: Turner 1916:616 (new combination, re-described).

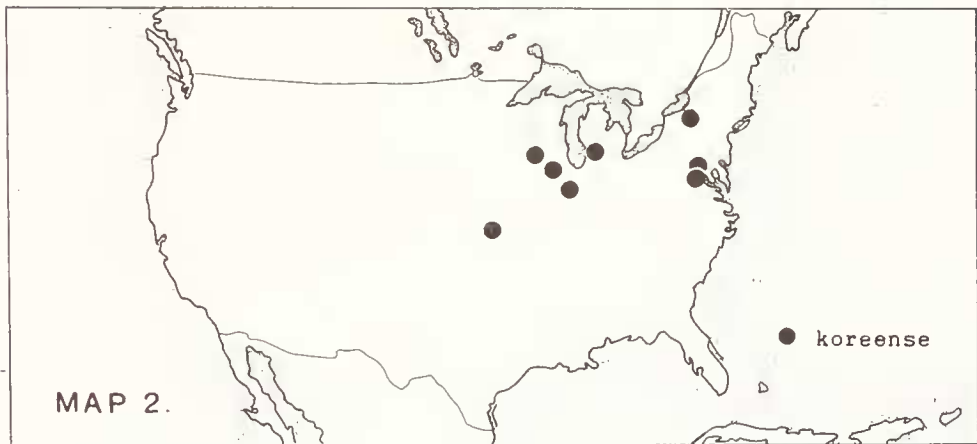
P. (Pison) agile: Bohart and Menke 1976:333 (listed).

P. agile: Menke 1988:38 (member of *agile* group, re-described).

Lectotype Selection.—The natural History Museum has two females with Smith's handwritten type labels. The first female has the museum white round label (1) with "Type" printed inside a red

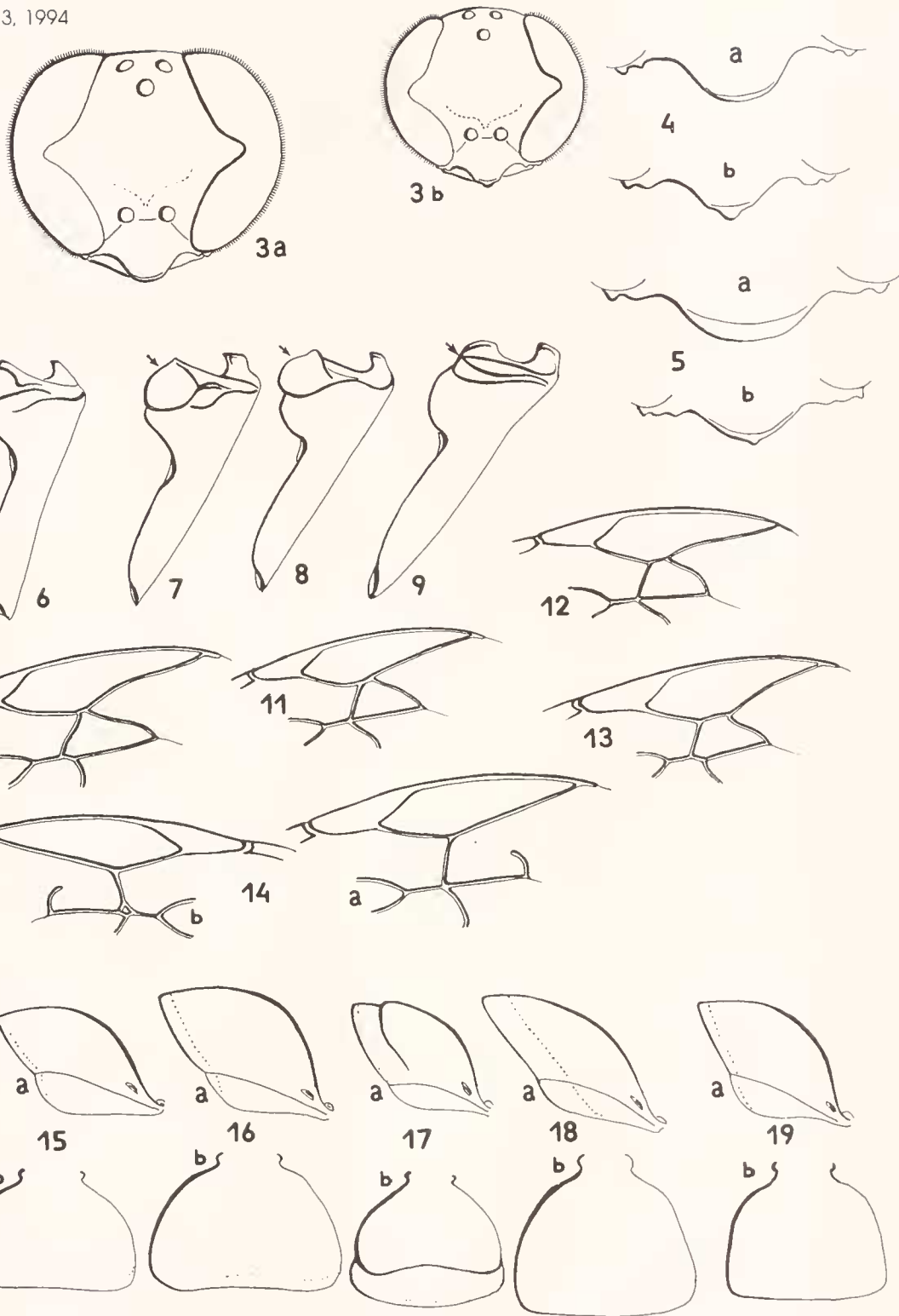


1



2

Fig. 1. Geographic distribution of the *Pison agile* species group in the Old World.
 Fig. 2. Geographic distribution of *P. koreense* in the New World.



Figs. 3-19. Morphological features of *Pison* species. 3, head in frontal view of *P. agile* (a, female; b, male). 4-5, clypeus in frontal view (a, female; b, male): 4, *P. agile*; 5, *P. pulawskii*. 6-9, right metapleuron in lateral view (arrow shows metapleural flange): 6, *P. agile*; 7, *P. koreense*; 8, *P. rothneyi*; 9, *P. pulawskii*. 10-13, submarginal cell area of right forewing: 10, *P. agile*; 11, *P. browni*; 12, *P. vechti*; 13, *P. pulawskii*. 14, submarginal cell area of forewing of *P. agiloides* (a, right; b, left). 15-19, abdominal tergite I (a, lateral view; b, dorsal view): 15, *P. agile*; 16, *P. koreense*; 17, *P. browni*; 18, *P. vechti*; 19, *P. pulawskii*.

oval, a pale-blue round label (2) with "India" handwritten on the upper side and "56/150" handwritten in two lines on the under side, a white rectangular label (3) with "agilis Sm. Type" handwritten in two lines, and the museum white rectangular label (4) with "B.M. TYPE. HYM." printed in two lines and "21.538" handwritten below. Another female has a pale-blue round label (1) with "Ceylon" handwritten on the upper side and "61/36" on the under side, a pale-blue rectangular label (2) with "P. agilis Smith. Type" handwritten in two lines. Only "Ceylon" was mentioned as the type locality in the original description so the "India" type may not be a true type. The Natural History Museum also has more than a dozen *agile* females from "Ceylon" and three of them have the same pale-blue round labels found on the second "type." I believe them to be the members of the type series and I have selected the specimen with Smith's type label as lectotype and the three other females as paralectotypes. I am discounting the Indian specimen as a type.

Discussion.—*Pison agile* is a member of a subgroup of species with mainly dark legs. Together with *agiloides* sp. n., it differs from other such species in having comparatively fine microsculpture of abdominal tergum I in which the interspaces are polished. The remaining terga are similarly polished. *Pison agile* differs from *agiloides* in having completely brown mid and hind legs, sparser and coarser scutal punctures and narrower whitish translucent apical tergal bands.

Range.—Known only from southern India and Sri Lanka.

Material Examined.—2 males, 18 females. INDIA: Anamalai Hills, Cinchona (BMNH, NMNH). SRI LANKA: North Western Prov., Kurunegala Dist., Kurunegala; Central Prov., Kandy Dist., Kandy, Udawattakele (BMNH, USNM, ZMUM).

Pison browni (Ashmead)

Figs. 11, 17

Pisonoides browni Ashmead 1905:961. Holotype: male, Philippines, "Manila" (USNM no. 8332), examined.

P. (Pisonoides) browni: Turner 1916:617 (new combination, listed).

P. (Krombeiniellum) browni: Bohart and Menke 1976:337 (new combination, listed).

P. (Krombeiniellum) browni: Tsuneki 1983:81 (redescribed)

P. browni: Menke 1988:38 (member of *agile* group).

Discussion.—This is the darkest species in the *agile* group, differing from other members by the narrow, brown apical bands on terga II-III, by the strong, transverse preapical depression of tergum I and the shallow depressions that delimit the propodeal dorsum. The last character is unique in the group.

Range.—Philippines.

Material Examined.—1 male, 2 females. LUZON: Manila (USNM), Laguna (CAS). Tsuneki (1983) recorded the species from Bontoc, Luzon; Mambucal, Negros; Cagayan de Oro, Mindanao.

Pison differens Turner

P. (Pisonoides) differens Turner 1916:617. Lectotype: female, India, "Shillong, Assam" (BMNH No. 21.540), present designation.

P. (Krombeiniellum) differens: Bohart and Menke 1976:337 (new combination, listed).

P. differens: Menke 1988:38 (member of *agile* group).

Lectotype Selection.—Turner described this species from three females without selecting a holotype. They have two identical rectangular labels: (1) "Shillong. 5.03" handwritten in two lines and (2) "Assam. R. Turner. 1905-125" printed in three lines ("Shillong, Assam, 5000 ft. (Turner), May" was mentioned in the original description). One female has in addition Turner's label "*Pison (Pisonoides) differens*. Turn. Type." handwritten in four lines and two museum labels, a round one with "Type. H.T." printed in two lines inside a red ring and a white rectangular one with "B.M. TYPE. HYM." printed in two lines and "21.540" handwritten below. I have selected the last female as lectotype and the two others as paralectotypes.

Discussion.—*Pison differens* is similar to *rothneyi* in color of the body and of the translucent apical tergal bands. The female differs from *rothneyi* by its comparatively small lateral ocelli and elongate propodeum with its hindface punctate (transversely carinate in *rothneyi*). The male also has very small ocelli but the propodeum is not elongate. In both sexes the propodeal dorsum is polished, finely sparsely punctate. The scutum is finely densely punctate in females. I think that *differens* may be a local form of *rothneyi* but more material will be required to resolve this.

Range.—Known only from Assam State, India.

Material Examined.—1 male, 3 females. INDIA: Assam State, Shillong, IV.1903, V.1903 (BMNH).

Pison erythropus Kohl

Parapison rufipes Smith 1869:299. Lectotype: female, "India" (BMNH No. 21.539), present designation. Nec *Pisonitus rufipes* Shuckard 1838:79 (now in *Pison*).

Parapison rufipes Horne, in Horne and Smith 1870:165 (biology).

P. rufipes Smith, in Horne and Smith 1870:188 (redescribed).

Pison (*Parapison*) *erythropus* Kohl 1885:183 (new name for *Parapison rufipes* Smith 1869, nec *Pisonitus rufipes* Shuckard 1838).

P. (Parapison) erythropus Kohl 1885:186 (listed).

P. erythropus: Bingham 1897:221 (listed).

P. Pisonoides *erythropus*: Turner 1916:616 (listed).

P. (Pison) erythropus: Bohart and Menke 1976:335 (new combination, listed).

P. erythropus: Menke 1988:38 (member of *agile* group).

Lectotype Selection.—The Natural History Museum has three females of this species bearing round labels with "India" handwritten on the upper side and "98.69" on the under side. One of them also has a rectangular label with "rufipes Sm. Type" handwritten in two lines. I believe them to be the members of the type series and I have selected the last female as lectotype and the other two females as paralectotypes.

Discussion.—*Pison erythropus* belongs to the subgroup whose members have brightly colored legs. This species is easily recognized by its entirely reddish-orange legs (including tarsi and basal parts of the trochanters).

Biology.—The nests observed by Horne (1870) in northwestern India as *Parapison rufipes* (Sm.) included "a mass of loosely arranged cells of earth attached to some hanging objects, such as a creeper, tendril, or pendent straw, or even a curled dry leaf." Horne mentioned that the cells were "very globular" and that their walls consisted of comparatively large "pellets...loosely attached to one another." He also "counted eighteen ("smallest spiders" in Horne) in two chambers." Nothing was reported about the number of cells per nest, the species or even family of the prey nor was the cocoon described.

Range.—Known with certainty only from western India.

Material Examined.—2 males, 9 females. INDIA (BMNH, ZMUM); Maharashtra District, Western Ghats, Lonavale (NMNH).

Pison hissaricum Gussakovskij

P. (Parapison) hissaricum Gussakovskij 1937:622. Holotype: female, Tajikistan, "Stalinbad" (now Dushanbe) (ZIN), examined

P. (Pison) hissaricum: Bohart and Menke 1976:336 (new combination, listed).

P. hissaricum: Menke 1988:38 (member of *agile* group).

Discussion.—*Pison hissaricum* also belongs to the subgroup whose members have brightly colored legs. This species can be recognized by the following combination of features: legs except trochanters, tarsi and tibiae reddish apically; tergum I dull due to dense microsculpture of interspaces, punctures of tergum I dense; and whitish translucent apical bands of terga I-III narrow.

Range.—Known from Uzbekistan and Tajikistan.

Material Examined.—8 males, 10 females. UZBEKISTAN: Aman-Kutan (ZMUM). TAJIKISTAN: Dushanbe; Varzob Valley, Kondara (ZIN, ZMUM).

Pison koreense (Radoszkowski)

Figs. 7, 16

Paraceramus koreensis Radoszkowski 1887:433. Holotype: female, "Koree" (Krakow, Poland. Lost). Neotype: female, Russia, Primorskiy Krai (ZMUM), present designation.

Ceramus koreensis: Morawitz in Dalla Torre 1894:3 (new combination, listed in Vespidae).

Pison (Parapison) koreense: Kohl in Dalla Torre 1897:712 (new combination, listed in Crabroninae).

Pison (Pisonoides) koreensis: Turner 1916:617 (new combination, listed).

P. (Pisonoides) koreensis: Yasumatsu 1935:229 (listed).

P. (Parapison) koreense: Gussakovskij 1937:622 (listed).

P. (Pisonoides) koreensis: Yasumatsu 1939:83 (listed).

P. (Paraceramus) koreense Krombein 1958a:166 (first record from United States).

P. (Paraceramus) koreense: Krombein 1958b:189 (listed).

Krombemiellum koreense: Richards 1962:118 (new name for *Paraceramus* Radoszkowski 1887, nec Saussure 1854).

P. (Pisonoides) koreensis: Iwata 1964:1 (biology).

P. (Krombemiellum) koreense: Krombein 1967:394 (new combination, listed).

P. (Krombemiellum) koreense: Menke 1968a:7 (listed).

P. (Krombemiellum) koreense: Menke 1968b:1102 (redescribed).

P. koreense: Sheldon 1968:107 (biology, larval morphology).

P. (Krombemiellum) koreense: Hawkins 1974:279 (biology).

P. (Krombemiellum) koreense: Bohart and Menke 1976:337 (listed).

P. (Krombemiellum) agile: Krombein, et al 1979:1641 (synonymized).

P. koreense: Kazenas 1980:92 (listed).

P. agile: Menke 1988:38 (listed).

Neotype Selection.—At my request, A. P. Rasnitsyn recently searched for the type of *koreense* in Radoszkowski's collection in Krakow, Poland but could not find it. I presume it was lost and I have selected a specimen from the southern part of Primorskiy Kray (32 km SE Ussurijsk, 25.VIII.1986; eastern Russia not far from Korea) as the neotype.

Discussion.—*Pison koreense* is the best known member of the *agile* group because its biology has been studied both in its native habitat in Japan (Iwata 1964) and in the United States (Sheldon 1968) where it was introduced apparently after World War II (Krombein 1958a).

Krombein (1979) synonymized *koreense* with *agile* and Menke (1988) accepted this synonymy. After comparing the syntypes of *agile* with material from Sri Lanka, Japan, Russian Far East and the United States, I have concluded that *koreense* is a distinct species. It differs from *agile* in having a dull tergum I that contrasts with a shiny tergum II (tergum I shiny in *agile*). *Pison koreense* also differs from *agile* in having bright golden translucent apical bands on terga II-III (whitish in *agile*), largely yellowish tibiae (brown in *agile*) and a transversely carinate propodeal hind surface (mostly punctate in *agile*). The metapleural flange of *koreense* is broad and reddish (Fig. 7); it is narrow and dark in *agile* (Fig. 6). *Pison koreense* differs from *differens* and *rothneyi* in having a more compact abdomen and a weakly developed translucent apical band on tergum I.

Biology.—The wasps were studied in detail in Japan by Iwata (1964) and in North America by Sheldon (1968) who also provided a detailed description of the immature stages of *koreense*. Both Iwata and Sheldon observed that *koreense* constructed small (6.0-10.2 X 4.0-6.0 mm), fragile, cylindrical mud cells with finely cemented walls. The cells are placed separately or in groups of up to 21 independent cells. The cells are attached in various protected places: inside a photographic tank (Krombein 1958a); in a culvert, in small depressions and cracks and under a bridge (Sheldon 1968); in the nooks of a mud wall under eaves (Iwata 1964); and even within the old empty cells of *Trypoxylon* (*Trypargilum*) *politum* (Say) (Sheldon 1968; Hawkins 1974). Construction of cells on

plants, as in *erythropus*, is unknown. The cells were provisioned with six immature spiders of the genus *Araneus* (Araneidae) (Iwata 1964) or by 20-31 small spiders of the genus *Dictyna* (Dictynidae), including males and females of *D. bellans* Chamberlin and *D. sublata* Hentz (Sheldon 1968). *P. koreense* cocoons are cylindrical (6.0-9.1 X 2.0-3.6 mm) and, according to Sheldon, were surrounded by "delicate silken threads attaching cocoon to inside of cell." Sheldon also mentioned a large number of adult *Melittobia chalybii* Ashmead (Eulophidae) which were reared from *koreense* cocoon "from a nest constructed in an unsealed cell of *Trypoxylon politum*."

I also observed nesting and hunting activities of *koreense* during 1983-1986 in the Primorskiy Kray in the Far East of Russia. The females made their small clay cells between logs in the wall of an old rural shed, placing them in groups of up to 20 independent cells. Five to seven specimens of immature spider of the genus *Araneus* were put into each cell. When hunting the female of *koreense* looked for the prey on their webs and attacked them from the dorsum, embracing the carapace and applying a single sting to the venter of the spider. After paralyzing the spider, the female turned the prey venter up, clutched the base of its chelicerae with her mandibles and flew with it to her cell. I observed egg-laying only once and it was the last operation before sealing the cell. Sheldon (1968) also mentioned that the egg was attached to the abdomen of the last spider in the cell.

Thus, populations of *koreense* in Russian Far East, Japan and the United States have similar biological features except prey. Spiders of the family Dictynidae were preferred in North America and Araneidae in eastern Asia.

Range.—Russian Far East, Korea, Japan, eastern China, United States: Illinois, Kansas, Maryland, Michigan, New York, Virginia, Wisconsin.

Material Examined.—28 males, 18 females. RUSSIA, Primorskiy Kray: Sichote-Alin, Vangou; 32 km SE Ussurijsk; Partizansk; 70 km ENE Partizansk (CAS, USNM, ZMUM). CHINA, Zhejiang: Hangchow (USNM). JAPAN, Fukui, Mt. Haku: Ichinose; Chugu; Mie (USNM, ZMUM). USA: Kansas, Lawrence; Virginia, McLean (USNM).

Pison rothneyi Cameron

Fig. 8

P. (Parapison) rothneyi Cameron 1897a:81. Holotype: female, India, West Bengal State, "Barrackpore" (now Barakpur) (OUM), examined.

P. (Parapison) crassicornis Cameron 1897a:25. Holotype: male (female in original description), India, West Bengal State, "Barrackpore" (now Barakpur) (OUM), examined. Synonymy by Turner (1916:617).

P. (Pisonoides) rothneyi: Turner 1916:617 (new combination, listed).

P. (Krombeiniellum) erythropus: Tsuneki 1974:637 (new combination, misidentified).

P. (Pison) rothneyi: Bohart and Menke 1976:336 (listed).

P. rothneyi: Menke 1988:38 (member of *agile* group).

Discussion.—This species is similar to *differens* and also *koreense*, differing from the first by the narrower translucent whitish-yellow apical bands of the terga, by the comparatively larger ocelli and by the shorter propodeum whose dorsum is distinctly punctate and the hind surface transversely carinate apically. Also, *rothneyi* has a more coarsely sculptured scutum and deeper impressed parapsidal lines. *Pison rothneyi* differs from *koreense* by the comparatively longer abdominal terga with well developed whitish-yellow translucent bands on all terga, including tergum I. *Pison rothneyi* also has a broader, spoon-shaped reddish-orange metapleural flange (Fig. 8) and its tergum I is shiny (semidull in *differens* and *koreense*). Tsuneki (1974) misidentified specimens of *rothneyi* as *erythropus*. The dark femora and tarsi of his specimens confirm this.

Range.—This is the most widely distributed Oriental member of the *agile* group. It is recorded from eastern India, Thailand, Viet Nam, Malaysia and Indonesia.

Material Examined.—1 male, 13 females. INDIA, West Bengal: Barrackpore (OUM). THAILAND, Chiang Mai Province: Fang Horticultural Exp. Station; Doi Inthanon N. P.: Huai Sai Luang (ZMK). Malaysia: Teluk Merban (ZMK); Kuala Lumpur (BMNH). VIET NAM: Tonkin, Poste de Dong-Dang (ZMUM). INDONESIA, Sumatra: Pakanbaru, Solok; Java: Bogor, Semarang (NMNH).

Pison agiloides Antropov, new species

Fig. 14

Description of Holotype Female.—Black except the following reddish: palpi, mandible largely,

labrum, tibiae except apically, femora apically, pronotal lobe posteriorly, tegula and metapleural flange; translucent apical bands of abdominal terga I-V and sterna II-V, and terga I-V laterally yellowish-white.

Clypeus, frons beneath, pronotum anteriorly, scutellum, metanotum and propodeum with dense erect silvery pubescence, longest setae on propodeum laterally and posteriorly; pronotal collar, scutum, mesopleuron and abdomen with suberect, dense, short pubescence, longest setae on apical band of tergum I.

Labrum slightly emarginate apically, inner orbits almost parallel, OOD < OD.

Frons densely punctate, interspace smooth, shiny; scutum densely, finely punctate, punctures separated by less than a diameter; scutellum, mesopleuron, metanotum and propodeum more sparsely punctate, punctures 1-3 diameters apart, interspaces polished; propodeal dorsum not enclosed by sulcus or carina; metapleural flange broad, spoon-shaped, translucent, with long silvery setae.

Right forewing (Fig. 14a) with two, left forewing (Fig. 14b) with three submarginal cells, outer submarginal cell of forewings open distally; recurrent vein II ending on tiny submarginal cell II (left forewing) and interstitial on right forewing.

Abdomen simple; terga shiny, densely punctate, diameter of punctures decreasing from basal to apical terga; tergum I with microsculpture, other terga more polished between punctures; sternum I similar to frons, other sterna densely, finely punctate, shiny; translucent apical bands of abdominal segments 1.5 to twice as broad as diameter of first hind tarsomere.

Male.—Unknown.

Discussion.—The new species differs from *agile* in having the dense, fine punctuation of the scutum and abdomen, the longer propodeum, the comparatively short setae of the thorax and abdomen, the broad translucent apical bands of the abdominal segments and the reddish tibiae and metapleural flange. The last features are shared with *rothneyi*, but the latter has completely reddish tibiae, tergum I is shiny and the propodeum is elongate. *Pison differens* also has fine, dense scutal punctures, but it differs from *agiloides* by its larger OOD, by its dark-brown tibiae and by the weakly shiny surface of tergum I.

The open second submarginal cell of the unique

specimen of *agiloides* may prove to be individual when more material is available. The presence of the true second submarginal cell in the left forewing is likely to be atypical also, but it illustrates that the loss of this cell is achieved via diminution of its size in the *agile* group (see also Menke 1988).

Etymology.—The ending of the species name emphasizes the likeness of this species and *agile*.

Range.—Sri Lanka.

Type.—Holotype female: SRI LANKA, Sabaragamuwa Province, Ratnapura District, Belihuloya Resthouse, 9.IV.1978, M. D. Hubbard, T. Wijesinhe (USNM).

***Pison ningyuenfuense* Antropov, new species**

Description of Holotype Female.—Black except the following reddish: palpi, mandible largely, labrum, foretibia anteriorly, midtibia basally, hindtibia basally and posteriorly and all spurs; apical rim of clypeus, tarsi ventrally and tegula reddish-brown; metapleural flange brown; translucent apical bands of abdominal terga I-V whitish.

Pubescence silvery; clypeus, frons, vertex, pronotum, scutum posteriorly, scutellum, metanotum and propodeum with erect setae, longest on pronotum laterally and on propodeum; gena, mesopleuron and abdomen with suberect, dense, short setae, those on gena and lateral angles of abdominal tergum I longest; scutum with extremely short, erect setae as on femora.

Pronotum and scutum finely and densely punctate, shiny, punctures less than a diameter apart; mesopleuron, scutellum and metanotum more sparsely punctate (punctures 1-2 diameters apart); propodeum coarsely punctate (punctures at least twice as large as those on scutum); abdominal tergum I moderately coarsely, sparsely punctate (punctures similar in size to those on propodeum), interspaces weakly shiny due to dense microsculpture; sternum I similarly punctate but shiny; following abdominal segments densely, finely punctate (like scutellum), shiny.

Translucent apical bands of abdominal terga II-V as broad as diameter of first hind tarsomere, bands of tergum I and sterna II-V less than diameter of first hind tarsomere; apex of tergum I shallowly but distinctly depressed (depressed part as broad at middle as maximal diameter of hind tibia); terga II-IV laterally with rounded tubercles.

Recurrent vein I ending on submarginal cell I, recurrent vein II ending on submarginal cell II near its base (nearly interstitial).

Length 7.6 mm.

Male.—Unknown.

Discussion.—*Pison ningyuenfuense* differs from the most similar *browni* by having an undefined propodeal dorsum (no limiting sulcus or carina), by the comparatively shallowly depressed apical part of abdominal tergum I, which is more coarsely punctate, with interspaces only weakly shiny, and by the whitish translucent apical bands of terga I-V.

Etymology.—The species name is derived from the native name of the holotype locality.

Range.—Known only from the type locality in southeastern China.

Type.—Holotype female: CHINA, Hunan Province, Ningyuenfu, July 24-26-28, alt. 600-10,800, D. C. Graham (USNM).

***Pison vechti* Antropov, new species**

Figs. 12, 18

Description of Holotype Female.—Black except the following bright reddish-orange: palpi, mandible largely, fore and mid tibiae and fore femur completely, mid and hind femora except dorsum and hind tibia except posteriorly, tegula and metapleural flange posteriorly, apical band on abdominal tergum I and medial spots on terga II-III before translucent apical bands; pronotal lobe posteriorly and spical tarsomeres beneath yellowish; translucent apical bands of terga I-V and sterna II-VI bright golden.

Pubescence of head and thorax silvery, mainly golden on abdominal terga (especially on translucent bands laterally); frons, vertex, gena, pronotum, scutum, scutellum, mesopleuron and metanotum with dense, short, erect setae (not longer than mid ocellus diameter); propodeum posteriolaterally with longer dense, erect setae (almost twice as long as mid ocellus diameter); abdomen with suberect or almost appressed dense, short setae.

Labrum truncate apically; median lobe of clypeus obtusely angulate, with narrow, shiny apical margin; inner orbits almost parallel; $OOD < OD = POD$.

Clypeus, frons, pronotum and scutum densely, minutely punctate, weakly shiny (punctures

mostly less than a diameter apart); scutellum, mesopleuron and metanotum with sparse punctation (punctures 1.5-2.0 diameters apart), interspaces polished; metapleural flange broad, spoon-shaped, translucent posteriorly; propodeum posteriorly and laterally punctured like mesopleuron but obviously coarser; propodeal dorsum shiny, not enclosed by sulcus or carina, with sparse punctures (2-4 diameters apart) and with deep median furrow containing simple carina on basal half; abdominal tergum I punctate (punctures 1-3 diameters apart), densely microsculptured, weakly shiny, sternum I, tergum and sternum II densely, finely punctate (punctures of sternum I coarsest), shiny; other abdominal segments densely micropunctate, surface smooth, weakly shiny; translucent apical bands of abdominal terga II-IV as broad laterally and medially as hindtibial diameter (those of terga I and V and sterna II-IV 1.5 times diameter of first hindtarsomere (Fig. 18).

Recurrent vein I ending on submarginal cell I, recurrent vein II ending near base of submarginal cell II, the latter very narrow anteriorly, almost triangular (Fig. 12).

Length 7.6 mm.

Variation in Females (18 specimens).—Femora and tibiae all bright reddish-orange in two females from Buitenzorg, Java (28.VI.1932) and Tembajangan, Kangean Island all femora dark posteriorly in a female from Mulie, Java, and submarginal cell II completely triangular in another female from Buitenzorg (16.X.1941). Length 7.0-7.8 mm.

Male.—As in female except: median lobe of clypeus narrower, acutely prominent apically; punctation sparser on scutum (punctures 1-2 diameters apart) and mesopleuron (punctures 2-4 diameters apart). Length 5.4 mm.

Discussion.—*Pison vechti* is very similar to *hissaricum*, *erythropus* and *differens* in having widened metapleural flange and largely bright reddish-orange legs. It is easily separated from *hissaricum* and *erythropus* in having the broad, golded, translucent apical bands of the terga. Furthermore, it differs from *erythropus* in having dark-brown trochanters and tarsi and a densely punctate, weakly shiny scutum. *Pison vechti* differs from *differens* in having the larger lateral ocelli and a comparatively short propodeum. The color of the abdomen of *vechti* is similar to *rothmeyei*, but the

latter has mainly brown femora and tibiae. *Pison pulawskii* also has bright reddish-orange legs but differs from all mentioned species in having a narrow metapleural flange.

Etymology.—This species is dedicated to Jacobus van der Vecht.

Range.—Malaysian Peninsula and southeastern Asian islands (Malaysian and Indonesian).

Types.—Holotype female: INDONESIA, E. Java, Idjen, Plateau Blawan, 900 m, 28.V.1939, J. v. d. Vecht (NMNH). Paratypes (1 male, 19 females): MALAYSIA, Kuala Lumpur: 27.X.1929, H. Pendlebury (NMNH); Tanglui Road, 20.V.1928, T. T. Pagden (BMNH). INDONESIA, Sumatra: Fort de Kock, 920 m, 1926, E. Jacobson (AUZM); Sibolga, 142°N-98 48'E, V_VIII.1954, W. Vergeest (NMNH); Java: Buitenzorg, J. v. d. Vecht; Buitenzorg, 16.X.1941, II.1953, J. v. d. Vecht; Buitenzorg, Pebaton, 28.VI.1932, J. v. d. Vecht; Buitenzorg, Jnsl. v. Pln., 15.VI.1929, J. v. d. Vecht; Malang, IV.1933, Betrem; Bogor, 1955, Hamann; Mulie; W. Preanger, Z. Soekaboemi, IV.1933, J. v. d. Vecht; Ambarawa, Lundeking (NMNH); Malang, IV.1933, Betrem (ZMUM); Mt. Tijoeng, Djampang Tengah, I.1939, K. M. Walsh (BMNH); Kangean Isl.: Tembajangan, II.1936, M. E. Walsh (NMNH).

Pison chrysoptilum Antropov, new species

Description of Holotype Female.—Black except the following reddish-orange: palpi, mandible except apically, labrum, pronotal lobe posteriorly, tegula mainly, widened part of metapleural flange, all femora except posteriorly and tibiae except apically; translucent apical bands of abdominal terga I-V golden.

Pubescence silvery on clypeus, mesopleuron, propodeum laterally and abdominal sterna, golden on frons, vertex, gena, pronotum, scutum, scutellum, metanotum, propodeal corsum and hindface and abdominal terga. Clypeus, pronotal collar, propodeal dorsum and terga with suberect or decumbent dense setae (shortest on abdomen, longest on pronotum); other areas with erect setae, shortest on scutum and abdominal sterna, longest on metanotum and propodeum posterolaterally.

Median clypeal lobe rounded, with narrow semitranslucent brown apical margin; inner orbits of eyes converging above; OD>POD>OOD.

Clypeus, frons, vertex, pronotum, scutum, scutellum and mesopleuron finely, densely punc-

tate (punctures 0.5-1.5 diameters apart), shiny; metapleural flange broad, spoon-shaped, widened part translucent; propodeum more coarsely, sparsely punctate laterally and dorsally (at least 2 diameters apart), hindface coarsely and densely punctate (0.5-1.0 diameters apart), with transverse ridges ventrally; propodeal dorsum not enclosed by sulcus or carina, with narrow median furrow containing simple carina; tergum I punctate (1-# diameters apart), shiny in spite of microstriation; sternum I with coarser punctures (as on propodeal hindface), shiny; other abdominal sclerites microscopically but distinctly, densely and uniformly punctate (approximately a diameter apart), shiny; translucent apical margins of terga I-IV twice as broad as diameter of first hind tarsomere (on tergum V and sternum III-V slightly less than diameter).

Recurrent vein I ending on submarginal cell I, recurrent vein II ending near base of submarginal cell II.

Length 8.2 mm.

Variation in Females (2 specimens).—Paratype female differs by its smaller size (6.2 mm) and almost parallel inner orbits of eye.

Male.—Unknown.

Discussion.—Unlike all other members of the *agile* group, *chrysoptilum* has golden pubescence on the frons, vertex, thorax and propodeum. It resembles *vechti* because of its brightly colored legs and golden translucent bands on the abdominal terga. *Pison chrysoptilum* and *vechti* may be two forms of one species, but more material will be necessary to resolve this.

Etymology.—This species name is derived from the Greek words *chrysos* (=gold) and *ptilon* (=down, fluff) emphasizing the color of the pubescence.

Range.—Northern Borneo (Sarawak, Brunei).

Types.—Holotype female: MALAYSIA, Sarawak: 4th div., Gn. Mulu, RGS Exp., 17.IX-23.X.1977, D. Hollis (BMNH). Paratype (1 female): BRUNEI: Ulu Temburong, Base camp hut, 300 m, 115 16'E, 4 26'N, 16.II-9.III.1982, M. C. Day (BMNH).

Pison pulawskii Antropov, new species

Figs. 5, 9, 13, 19

Description of Holotype Female.—Black except the following reddish-orange: palpi, mandible largely, labrum, fore legs distad of coxal apex, mid and hind legs except basal parts of coxae and

tarsomeres III-V; antennal articles beneath, apical margin of clypeus, tegula, mid and hind tarsomeres III-V reddish-brown.

Pubescence silvery only; clypeus, frons, vertex, pronotal collar, scutum, scutellum, metanotum, metapleuron and propodeum with erect setae, longest on propodeum posterolaterally and shortest on scutum (scarsely longer than on femora); gena, mesopleuron and abdomen with suberect or appressed short setae (longest on apical bands of terga and shortest on sternum).

Labrum truncate apically; clypeus comparatively broadly rounded (Fig. 5A); inner orbits of eyes almost parallel; OOD=OD=POD.

Frons densely punctate, shiny; scutum very densely, finely punctate, weakly shiny; mesopleuron uniformly, sparsely punctate (1.0-1.5 diameters apart), polished; metapleural flange not lamellate (Fig. 9); propodeal dorsum obliquely carinate basally and along median furrow, dorsum not enclosed by sulcus or carina, sparsely punctate (as on propodeal side) (1-3 diameters apart); tergum I uniformly, densely punctate (as on mesopleuron), shiny; tergum II more densely and finely punctate, shiny; remaining terga weakly shiny because of very dense microscopic punctures; sternum I dull, punctate as frons; sternum II shiny, punctate as mesopleuron; other sternum with dense micropunctures, weakly shiny; translucent apical bands of terga I-V and sternum II-IV whitish, as broad as diameter of hindtarsomere I (Fig. 19).

Recurrent vein I ending on submarginal cell I, recurrent vein II ending on submarginal cell II near its base (Fig. 13).

Length 7.0 mm.

Variation in Females (11 specimens).—Mid tarsi completely reddish-orange in three specimens from holotype locality and one from Kurumbagaram; hind tibiae and tarsi brownish posteriorly and antennal flagellum completely dark-brown in one specimen from Coimbatore. Length 6.0-7.0 mm.

Males (3 specimens).—As in females except: clypeus with acute median prominence apically (Fig. 5b); labrum slightly emarginate; mandibles without inner teeth. Length 4.8-5.2 mm.

Discussion.—The nonlamellate metapleural flange of *pulawskii* sets the species apart from other in the *agile* group. Other features of the species are the form of the clypeus, the mostly reddish-orange

legs and the narrow whitish translucent apical bands of the abdominal segments. Reddish legs occur in *erythropus* and whitish abdominal bands occur in *erythropus*, *agile* and *ningyuenfuense*, but these species have a lamellate metapleural flange.

Etymology.—This species is dedicated to Wojciech J. Pulawski.

Range.—Western and southern India.

Types.—Holotype female: INDIA, Rajasthan: Udaipur (24 35'N), 27.V.1989, W. J. Pulawski (CAS). Paratypes (3 males, 9 females): same place, date and collector as holotype (CAS); same place and collector as holotype, 21-25.V.1989 (CAS, ZMUM); Gujarat: Disa (=Deesa), 4-6.VI.1989, W. J. Pulawski (CAS); Karnataka: Bangalore, 915 m, 26.V.1980, 30.V.1980, K. D. Ghorpade (ZMK); Karikal Territory: Kurumbagaram, III.1947, P. S. Nathan (USNM).

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